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BIFOCAL OPHTHALMIC LENS HAVING DIFFERENT COLOR DISTANCE AND NEAR VISION ZONES

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This invention relates to a lens for correcting the vision of a patient, and particularly to a bifocal lens utilizing color as a means to secure a near vision effect in a lens which otherwise has a prescription for the far vision of the patient.

One object of the invention is to provide a lens which may be designed as either a spectacle lens or a contact lens (either scleral or corneal type) having a far zone and a near zone which are powered for distance viewing of the patient, but in which the near zone is characterized by being colored to thereby operate to focus rays from a source through the near zone at a shorter distance in the eye than rays from such source through the far zone, thereby securing a bifocal effect by the use of color in the near zone.

Another object is to provide such a lens which is a corneal contact lens so fitted to the eye as to result in distance vision through the far zone of the lens when the patient is looking ahead in the normal manner but which shifts in relation to the cornea so that central vision of the eye shifts from the far zone to the near zone when the eye is downcast as for reading, the color in the near zone being thereupon operable to secure in effect a greater magnification of the object being viewed due to chromatic aberration of the eye.

Still another object is to provide the lens when of corneal character with a near zone which is an outer zone of annular shape entirely surrounding the far zone whereby the outer zone is equally effective for near vision in all positions of rotation of the lens with respect to the cornea.

A further object is to provide for increasing the differential in doptric power as between the far zone and the near zone by selecting a color in the lower wavelength half of the visible spectrum for the near zone and selecting a color in the upper half of the visible spectrum for the far zone.

Still a further object is to provide a bifocal lens having one or both zones colored, the power of a colored zone being obtained by a combination of physical curvature and color in which the color used and the chormatic aberration of the eye are taken into consideration and the curvature of the lens surface is formed accordingly.

An additional object is to provide a bifocal lens that can be made thinner than otherwise when color is used in either or both the far and near zones of the lens to provide a magnification effect resulting from chromatic aberration of the eye.

With these and other objects in view, my invention consists in a bifocal lens of such character as to achieve the objects above contemplated, as hereinafter more fully set forth, pointed out in my claims and illustrated in detail on the accompanying drawings, wherein:

FIG. 1 is a vertical diagrammatic cross section through the human eye showing a typical form of my bifocal lens applied as a corneal contact type of lens in wearing position on the cornea with the eye looking straight ahead for central vision through the far zone of the lens;

FIG. 2 is a front elevation of the lens shown in FIG. 1;

FIG. 3 is an enlarged sectional view on the line 3—3 of FIG. 2 showing a modification;

FIG. 4 is a sectional view somewhat similar to FIG. 1 in which the eye is shifted to a downcast position and

the near zone of the lens is in operation as far as central vision is concerned;

FIG. 5 is an optical diagram following FIG. 1 and showing the focusing of a far object on the retina of the eye after passing through the far zone of the lens;

FIG. 6 is a similar diagram following FIG. 4 and showing the focusing effect from the far object when viewed through the near zone of the lens;

FIG. 7 is a similar diagram following FIG. 4 and showing the focusing of a near object through the near zone onto the retina;

FIG. 8 is a front elevation of a modified form of my bifocal lens, and

FIG. 9 is a vertical sectional view of my bifocal lens of suitable size for mounting in a spectacle frame.

On the accompanying drawing I have used the reference numeral **10** to indicate in general the cornea of the eye. The cornea has a central apical area which is substantially spherical and a peripheral area surrounding the central area which departs from the spherical shape of the apical area, being somewhat flatter or of greater radius, the radius increasing (but somewhat irregularly) away from the apical area.

Surrounding the cornea **10** is the sclera **12** or white portion of the eye. The transition from cornea to sclera is the limbus which defines the limbal area within which a corneal contact lens is usually positioned. Just back of the cornea **10** is the iris or diaphragm **14** which defines the iris opening or pupil **16**. The sensory end organ of the eye is the retaina **20** which includes a central vision area **22** comprising a group of visual cells surrounding a central optical rod or rhabdom **23** (which is usually termed the foveal centralis). The rest of the retaina **20** involves peripheral vision.

Man has "camera" eyes including a crystalline lens **18** suspended between the chamber **26** containing vitreous humour and a chamber **28** containing aqueous humour. The rear of the chamber **26** is lined with the retina **20**. The cornea **10** acts as a lens in front of the chamber **28** and of course is transparent, its apparent color being that of the iris **14**. The iris is activated by muscles which control the size of its central opening or pupil **16** through which light enters the eye. Light passing through the lens **18** is focused on the retina as an image and the varied stimuli act on nerve endings of the retina to result in a definite mental image transmitted to the brain by the optic nerve **24**. The eyes are provided with muscles which direct them toward objects to be observed. They also have muscular focusing devices which control the curvature of the lens **18** and thus its focus with respect to the retina.[1]

In FIG. 1 I have shown a lens L^1 embodying my invention fitted to the cornea, and in FIG. 9 a similar lens L^4 embodying my invention but mounted in a spectacle frame. I will first describe the lens L^1 and the action thereof whereupon the same action for the lens L^4 will be obvious.

The lenses L^1, L^3 and L^4 are shown as having far zones **30**, **30***a* and **30***b* and near zones **32**, **30***b* and **32***b* respectively. They may be made of plastic material such as methylmethacrylate but the near zone is colored (such as blue) whereas the far zone **30** is clear plastic. A colored near zone gives a bifocal effect as will hereinafter appear.

A corneal contact lens may be designed to operate with bifocal action in accordance with my Patent No. 3,031,927. Briefly the posterior surface of the lens is curved to fit the cornea of the patient to which the lens is applied with a tendency to remain centered thereon. Such a fit involves a posterior radius of curvature approx-

[1] Van Nostrand's Scientific Encyclopedia, 2nd ed., 1947, page 555.